



ATTORNEY DOCKET NO: 70179

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : CANNON
Serial No : 09/866,400
Confirm. No : 7580
Filed : May 25, 2001
For : APPARATUS AND METHOD...
Art Unit : 2877
Examiner : Pham, H.
Dated : February 20, 2002

RECEIVED
MAR - 1 2002
TECHNOLOGY CENTER 2800

5/a
C. Stealy
2-5-02

Hon. Commissioner of Patents
and Trademarks
Washington, D.C. 20231

AMENDMENT

In response to the Office Action dated August 20, 2001, please amend the above-identified application as follows:

IN THE CLAIMS:

Please amend claim 1 as follows:

1. (AMENDED) An apparatus for the visual inspection of soldered joints between an electric or electronic component disposed on the surface of a printed circuit board and the printed circuit board, the apparatus comprising:

an ocular unit;

a lens head;

an image transmission unit for transmitting the image received by said lens head to said

A

ocular unit; and

an illuminating device for illuminating the soldered joints to be inspected, said lens head comprising a device for image deflection extending up to an axially outermost end of said lens head, said illuminating device being disposed in said lens head to provide a light exit directed toward the soldered joints to be inspected, said light exit being disposed besides said device for image deflection at the axially outer end of said lens head.

Cont.
a1
[Please amend claim 2 as follows:]

2. (AMENDED) The apparatus according to claim 1, wherein said light exit of the light of the illuminating device from the lens head is a bilateral exit next to the device for image deflection.

[Please amend claim 3 as follows:]

3. (AMENDED) The apparatus according to claim 1, wherein the device for image deflection comprises at least one deviating prism or at least one deviating mirror.

[Please amend claim 4 as follows:]

4. (AMENDED) The apparatus according to claim 1, wherein the deviation angle of the device for image deflection is between 0 and 180 degrees.

[Please amend claim 5 as follows:]

5. (AMENDED) The apparatus according to claim 4, wherein the deviation angle of the device for image deflection is substantially 90 degrees.

[Claim 6 has not been changed by this amendment and remains as follows:]

6. The apparatus according to claim 1, wherein the lens head has a focal length such that the depth of field area of the image corresponds to at least half of a largest component size of the component on the printed circuit board.

[Claim 7 has not been changed by this amendment and remains as follows:]

7. The apparatus according to claim 1, wherein the lens head comprises a housing with at least one laterally open recess tapering towards the axially outer end of the lens head and bounded on both sides by flange-type webs, wherein a deviating prism or deviating mirror is disposed in the housing to cause a free surface of the deviating prism or the mirror surface in the recess faces outwards and the lower lateral edge of the deviating prism or of the deviating mirror seals the lens head towards the axially outer end, and wherein further the light exits of the illuminating device are arranged in the flange-type webs.

[Claim 8 has not been changed by this amendment and remains as follows:]

8. The apparatus according to claim 1, wherein the illuminating device comprises at least one glass fiber bundle with first and second ends, said first axial end is connectable to a light source and forms with said second axial end the light exit of the illuminating device on

the lens head.

[Please amend claim 9 as follows:]

9. (AMENDED) The apparatus according to claim 1, wherein the image transmission unit comprises at least one glass fiber bundle which is optically couplable with its first end to the unit for image deflection , and with its second end to the ocular unit.

[Claim 10 has not been changed by this amendment and remains as follows:]

10. The apparatus according to claim 1, wherein a second illuminating device, positionable substantially in a viewing direction of the apparatus opposite the lens head, illuminates in the direction of the lens head.

[Claim 11 has not been changed by this amendment and remains as follows:]

11. The apparatus according to claim 10, wherein the second illuminating device comprises a counterlight head with a housing with at least one laterally open recess tapering towards the axially outer end of the counterlight head, wherein in the housing a deviating prism or a deviating mirror, which is optically couplable to a light source via a glass fiber bundle, is disposed with the free surface of the deviating prism or the mirror surface in the recess facing outwards and the lower lateral edge of the deviating prism or of the deviating mirror seals the counterlight head towards the axially outer end.

[Claim 12 has not been changed by this amendment and remains as follows:]

12. The apparatus according to claim 10, wherein the second illuminating device comprises a counterlight head which is of substantially identical construction to the lens head.

[Claim 13 has not been changed by this amendment and remains as follows:]

13. The apparatus according to claim 10 wherein the glass fiber bundle at least of the second illuminating device runs in a flexible spiral tube.

[Claim 14 has not been changed by this amendment and remains as follows:]

14. The apparatus according to claim 11, wherein the glass fiber bundle of the lens head and of the counterlight head are connectable to the same light source.

[Please amend claim 15 as follows:]

15. (AMENDED) The apparatus according to claim 10, wherein the lens head and the second illuminating device are couplable via a linkage or rack to provide an exactly defined relative position of lens head and second illuminating device is adjustable.

[Claim 16 has not been changed by this amendment and remains as follows:]

16. The apparatus according to claim 15, wherein the linkage or rack comprises a freely projecting bracket which is fixable substantially rigidly to a housing section of the apparatus between lens head and ocular unit or is part of the housing section, wherein the

A

5 bracket comprises, displaceable in longitudinal direction in a guide element, a holding device
in which the second illuminating device is fixable, with which the axial distance between lens
head and counterlight head is adjustable.

Cont. a1
[Please amend claim 17 as follows:]

17. (AMENDED) A method for checking the quality of the soldered joint between an
electric or electronic component disposed on the surface of a circuit board including an SMD,
BGA, CSP or FC component, and the circuit board, the method comprising the steps of:

5 using an ocular unit with an apparatus including a lens head, an image transmission unit
for transmitting the image received by the lens head to the ocular unit and an illuminating
device for illuminating the soldered joints to be tested, in which the lens head comprises a
deviating prism for image deflection which extends up to the axially outermost end of the lens
head, and in which the illuminating device is disposed in the lens head to cause the exit angle
of the light of the illuminating device out of the lens head is substantially equal to the deviation
10 angle of the image deflection and the exit point of the light is disposed next to the deviating
prism for image deflection in the area of the axially outer end of the lens head, the component
comprising, arranged in rows and gaps after the manner of a matrix, a large number of solder
pins, solder balls or solder points which are solderable with a corresponding number of contact
points complementary as to shape and function disposed on the printed circuit board;

15 visually examining the soldered joints of the outermost row of soldered joints of a first
side of the component to be tested with the ocular unit, wherein the component is moved step-

wise according to the spacing of the solder joint rows or gaps past the lens head of the ocular unit or, conversely, the lens head of the ocular unit is moved step-wise past the component;

20 rotating of the component or the ocular unit through respectively 90 degrees and visually examining the soldered joints of the outermost rows of soldered joints of the further sides of the component with the ocular unit wherein the component is moved step-wise according to the spacing of the solder joints past the lens head of the ocular unit or, conversely, the lens head of the ocular unit is moved step-wise past the component; and

25 visually examining the channels formed between the respective gaps or rows for optical visibility.

[Claim 18 has not been changed by this amendment and remains as follows:]

18. The method according to claim 17, wherein said visually examining the channels is performed with a counterlight.

[Please amend claim 19 as follows:]

19. (AMENDED) The method according to claim 17, wherein in addition to said visually examining the soldered joints and said rotating the soldered joints of the inner rows are examined visually for soldering defects by viewing into the channels formed between the gaps or rows.

[Please amend claim 20 as follows:]

A

20. (AMENDED) An apparatus for the visual inspection of soldered joints disposed between an electric or electronic component and a substrate, the apparatus comprising:

an ocular unit

a lens head;

an image transmission unit for transmitting the image received by said lens head to said ocular unit; and

an illuminating device for illuminating the soldered joints disposed between the electric or electronic component and the substrate, said lens head comprising an image deflection device for changing the direction of the image path from an incoming direction from between the electric or electronic component and the substrate to an outgoing direction, said image deflection device extending up to an axially outermost end of said lens head, said illuminating device having a light exit to provide a light exit direction substantially toward said incoming direction, said light exit of said illuminating device being disposed circumferentially besides said device for image deflection.

[Please amend claim 21 as follows:]

21. (AMENDED) The apparatus according to claim 20, wherein said image deflection device changes the direction of the image path by an image deflection angle, said illuminating device having a light source and a light transmission path changing the direction of light from said light source to said light exit by an angle substantially equal to said image deflection angle.

A

[Please amend claim 22 as follows:]

22. (AMENDED) A visual inspection apparatus comprising:

an image transmission unit having a longitudinal axis with first and second ends at opposite longitudinal ends, said image transmission unit transmitting an image from said first end to said second end along said longitudinal axis;

a head arranged at said first end of said image transmission unit, said head extending a predetermined distance from said first end of said image transmission unit;

an image deflection device arranged in said head and being receivable of an external image at an image axis angularly spaced from said longitudinal axis of said image transmission unit, said image deflection device being feedable of the external image into said first end of said image transmission unit substantially along said longitudinal axis, said image deflection device being receivable of the external image at substantially a farthest longitudinal distance of said head from said transmission device;

an illuminating device in said head, said illuminating device emitting light substantially parallel to said image axis at a longitudinal position of said image deflection device.

[Please amend claim 23 as follows:]

23. (AMENDED) An apparatus in accordance with claim 22, wherein:

said image deflection device is receivable of the external image over a longitudinal image distance;

said illuminating device emits the light at a position within said longitudinal image

5

distance.

[Claim 24 has not been changed by this amendment and remains as follows:]

24. An apparatus in accordance with claim 23, wherein:

said longitudinal image distance has one longitudinal end at said farthest longitudinal distance of said head;

said illuminating device emits the light at a position adjacent said farthest longitudinal

5

distance.

[Please amend claim 25 as follows:]

25. (AMENDED) An apparatus in accordance with claim 22, wherein:

said head includes a web longitudinally extending along one side of said image deflection device, said web extending to said farthest longitudinal distance.

[Please amend claim 26 as follows:]

26. (AMENDED) An apparatus in accordance with claim 22, wherein:

said head includes a web longitudinally extending along one side of said image deflection device, said web extending substantially to said farthest longitudinal distance.

[Please amend claim 27 as follows:]

27. (AMENDED) An apparatus in accordance with claim 25, wherein:

said head includes another web longitudinally extending along another side of said image deflection device, said another web extending to said farthest longitudinal distance.

Cont'd
a1

[Claim 28 has not been changed by this amendment and remains as follows:]

28. An apparatus in accordance with claim 27, wherein:

each of said webs define an opening for emitting light from said illuminating device.

REMARKS

Claims 1-28 remain in the case and are presented for reconsideration. By this amendment, Applicant has made changes to the claims to clarify the subject matter of the application.

The Examiner has indicated that the claim for priority must be made in the present application.

Applicant notes that a claim for priority has been made in the present application. In the cover letter to the U.S. Patent Office filing this Continuation Application, under number 11 it is clearly stated that the priority claimed in the parent application is hereby claimed for this application. It is requested that the U.S. Patent Office records be checked to make sure that this claim for priority is properly recognized as being claimed.

The Examiner takes the position that the present Continuation Application presents new matter. The Examiner makes reference to particular claims. Applicant first notes that no new matter was added. Further, minor changes have now been made to the claims. However,

Applicant wishes to note that the objection is improper under U.S. guidelines. Particularly, where a claim presents what the Examiner claims to be new matter, the claim should be rejected wherein the issue can be resolved and appealed. Where new matter is introduced into the specification, the objection raised by the Examiner is proper wherein this may be contested via a petition. In the present case, if the claims contain what the Examiner alleges to be new matter, the claims should be rejected wherein the issue can be resolved at appeal.

Applicant respectfully requests that the Examiner reconsider the issue as to new matter.

With regard to claim 25 it is absolutely clear that each of the embodiments disclosed includes a web longitudinally extending along one side of the image deflection device. The fact that an additional web may also be provided is not meaningful with regard to the interpretation of the claim and with regard to the objection. The subject matter claimed is clearly disclosed and the new matter rejection is clearly improper. Further, with regard to the alternative language of the web extending to, or less than, the farthest longitudinal distance, this is also disclosed. Accordingly, the new matter rejection is clearly untenable with regard to this point as well. In view of the fact that the alternative language may relate to non-equivalent structures, Applicant has amended claims with regard to the extension of the web.

As the features claimed are clearly disclosed, Applicant requests that the Examiner reconsider this objection. Applicant requests that the Examiner at least clarify this objection as it is not clear what the Examiner considers to be "new matter".

The Examiner has rejected claims 1-28 as being indefinite.

Applicant notes that the term "image deviation" should be clear from considering the

specification. Another term also used in the specification is "image deflection" used for example at page 5, lines 1 and 7. In order to use a term which more readily conveys the meaning as to the claim structure, Applicant has amended some of the claims to indicate that a device for image deflection is provided, namely for redirecting the light reflected off of the image.

Applicant has made further changes to the claims to address the issues as to definiteness. Applicant wishes to thank the Examiner for the careful reading of the claims and for the helpful comments. It is Applicant's position that all claims are clear and definite as now presented. However, with regard to claims 17 and 19 and the use of "or" relating to an alternative, Applicant notes that this language is fully acceptable under U.S. practice. Particularly, under U.S. practice where the alternatives are equivalent, the claims should now be considered definite. Applicant has changed claim 25 for example wherein the alternatives may be considered non-equivalent. Accordingly, reconsideration of the rejection with regard to listed alternatives wherein the alternatives are equivalent is requested. The Examiner's attention is directed to the Manual of Patent Examining Procedure.

The Examiner has rejected claims 22-26 as being anticipated by Tagami (U.S. 5,170,775).

The claims including claim 22 highlight that the "image deviation device receives the external image at substantially the farthest longitudinal distance of the head from the transmission device. Neither the prism or mirror which provides the deflection of the image extends to the lowest point or axially outermost end of the head. This is the furthest extension

of the head structure. This feature is important according to the invention as it allows the user to inspect the smallest gaps between the circuit board and an electronic element. The prior art fails to teach and fails to suggest this feature in combination with the other features as claimed. The prior art cannot obtain the same results as according to the invention and the prior art fails to provide a suggestion of using the structure to attain the results as according to the invention.

The endoscope of Tagami includes a light omitting illumination window 20 that is below the observing window. Tagami clearly fails to meet the feature of the claim. Tagami also fails to provide the benefits which are provided according to the structural combination claimed. With the endoscope of Tagami it is definitely not possible to inspect gaps having a smaller height than the distance between the window 20 and the outermost lower end of the endoscope. This is a significant functional deficiency and the different between the function is directly related to the structural combination claimed. Applicant notes that Tagami represents the state of the art, namely the background described at page 3, paragraph 2 of the specification.

The Examiner appears to be ignoring an important feature of the invention. However, where the feature is clearly pointed out and where the prior art clearly fails to teach or suggest the feature, the feature in combination should be considered patentable. Certainly claim 22 is not anticipated by Tagami. Further, Tagami clearly fails to teach and clearly fails to suggest the features of claim 23 which include the features of claim 22. As Tagami discloses an endoscope, the illumination window is not within the longitudinal image reception distance, it is certainly and clearly below this. Further, with regard to other claims depending on claim

22, Tagami discloses an endoscope which clearly does not comprise any webs on one or either side of the image deviation device. In particular, Tagami fails to teach or suggest webs comprising the illumination device. Tagami clearly is lacking as to providing teachings of the claim combination. Accordingly, reconsideration of the rejection is requested.

The Examiner has also rejected claims 1-9, 17, 19-21 as being obvious based on the teachings of Tagami in view Woo et al. (U.S. 6,023,368).

Applicant again notes the deficiencies of Tagami are such that the reference fails to teach many features claimed particularly with regard to the independent claims. Further, the teachings of Woo fail to provide any suggestions or incentive to change the Tagami reference nor to provide the combination as claimed. Woo does not show an image deviation device extending up to the outermost end of the lens head and does not show a light exit disposed beside the device for image deviation. On the contrary, Tagami provides teachings directing a person of ordinary skill in the art to arrange the light exit below the image deviation device. This of course provides an arrangement which will not provide the results according to the invention. With regard to the structure, this arrangement is a teaching to arrange the light exit below the image deviation device. The image deviation device does not extend to the outmost end.

The Woo et al. reference clearly fails to provide a suggestion to present the combination of features as claimed in the independent claims.


The Examiner has rejected claims 1-21 under 35 U.S.C. §101 as claiming the same invention as claims of the co-pending application. Although the applications were co-pending

to provide priority under 35 U.S.C. §121 the above-referenced application became abandoned as noticed by the Patent Office on September 27, 2001. Accordingly, it is requested that the double patenting rejection be rescinded. Further, the obviousness-type double patenting rejection should also be removed.

Applicant notes that claim 18 has not been objected and Applicant requests that the Examiner indicated the allowability of this claim in view of no prior art being applied to this claim.

Favorable consideration on the merits is requested.

Respectfully submitted
for Applicant,

By:  REG# 34979 for
John James McGlew
Registration No. 31,903
McGLEW AND TUTTLE, P.C.

JJM:jj/da
70179.5

Enclosure: Version of the Claims Showing Changes

DATED: February 20, 2002
SCARBOROUGH STATION
SCARBOROUGH, NEW YORK 10510-0827
(914) 941-5600

SHOULD ANY OTHER FEE BE REQUIRED, THE PATENT AND TRADEMARK OFFICE IS HEREBY REQUESTED TO CHARGE SUCH FEE TO OUR DEPOSIT ACCOUNT 13-0410.

I HEREBY CERTIFY THAT THIS CORRESPONDENCE IS BEING DEPOSITED WITH
THE UNITED STATES POSTAL SERVICE AS EXPRESS MAIL IN AN ENVELOPE
ADDRESSED TO: COMMISSIONER OF PATENTS AND TRADEMARKS,
WASHINGTON, D.C. 20231, NO.: EV071195755US

McGLEW AND TUTTLE, P.C.
SCARBOROUGH STATION, SCARBOROUGH, NY 10510-0827

BY: *Fori Qun Serate* DATE: February 20, 2002

17

VERSION OF THE CLAIMS SHOWING CHANGES

1. (AMENDED) An apparatus for the visual inspection of soldered joints between an electric or electronic component disposed on the surface of a printed circuit board and the printed circuit board, the apparatus comprising:

an ocular unit;
a lens head;
an image transmission unit for transmitting the image received by said lens head to said ocular unit; and

an illuminating device for illuminating the soldered joints to be inspected, said lens head comprising a device for image ~~[deviation]~~deflection extending up to an axially outermost end of said lens head, said illuminating device being disposed in said lens head to provide a light exit directed toward the soldered joints to be inspected, said light exit being disposed besides said device for image ~~[deviation]~~deflection at the axially outer end of said lens head.

2. (AMENDED) The apparatus according to claim 1, wherein said light exit of the light of the illuminating device from the lens head is a bilateral exit next to the device for image ~~[deviation]~~deflection.

3. (AMENDED) The apparatus according to claim 1, wherein the device for image ~~[deviation]~~deflection comprises at least one deviating prism or at least one deviating mirror.

4. (AMENDED) The apparatus according to claim 1, wherein the deviation angle of the device for image ~~[deviation]~~deflection is between 0 and 180 degrees.

5. (AMENDED) The apparatus according to claim 4, wherein the deviation angle of the device for image ~~[deviation]~~deflection is substantially 90 degrees.

9. (AMENDED) The apparatus according to claim 1, wherein the image transmission unit comprises at least one glass fiber bundle which is optically couplable with its first end to the unit for image ~~[deviation]~~deflection, and with its second end to the ocular unit.

15. (AMENDED) The apparatus according to claim 10, wherein the lens head and the second illuminating device are couplable via a linkage~~[,]~~or rack~~[or similar]~~ to provide an exactly defined relative position of lens head and second illuminating device is adjustable.

17. (AMENDED) A method for checking the quality of the soldered joint between an electric or electronic component disposed on the surface of a ~~[printed]~~ circuit board~~[or similar]~~ including an SMD, BGA, CSP or FC component, and the ~~[printed]~~ circuit board, the method comprising the steps of:

using an ocular unit with an apparatus including a lens head, an image transmission unit for transmitting the image received by the lens head to the ocular unit and an illuminating

A

device for illuminating the soldered joints to be tested, in which the lens head comprises a deviating prism for image ~~deviation~~deflection which extends up to the axially outermost end of the lens head, and in which the illuminating device is disposed in the lens head to cause the exit angle of the light of the illuminating device out of the lens head is substantially equal to the deviation angle of the image ~~deviation~~deflection and the exit point of the light is disposed next to the deviating prism for image ~~deviation~~deflection in the area of the axially outer end of the lens head, the component comprising, arranged in rows and gaps after the manner of a matrix, a large number of solder pins, solder balls or solder points which are solderable with a corresponding number of contact points complementary as to shape and function disposed on the printed circuit board;

visually examining the soldered joints of the outermost row of soldered joints of a first side of the component to be tested with the ocular unit, wherein the component is moved step-wise according to the spacing of the solder joint rows or gaps past the lens head of the ~~apparatus~~ocular unit or, conversely, the lens head of the ~~apparatus~~ocular unit is moved step-wise past the component;

rotating of the component or the ~~apparatus~~ocular unit through respectively 90 degrees and visually examining the soldered joints of the outermost rows of soldered joints of the further sides of the component with the ocular unit wherein the component is moved step-wise according to the spacing of the solder joints past the lens head of the ~~apparatus~~ocular unit or, conversely, the lens head of the ~~apparatus~~ocular unit is moved step-wise past the component; and

visually examining the channels formed between the respective gaps or rows for optical visibility.

19. (AMENDED) The method according to claim 17~~[-]~~, wherein in addition to said visually examining the soldered joints and said rotating~~[-, at the same time or staggered in time,]~~ the soldered joints of the inner rows are examined visually for soldering defects by viewing into the channels formed between the gaps or rows.

20. (AMENDED) An apparatus for the visual inspection of soldered joints disposed between an electric or electronic component and a substrate, the apparatus comprising:

an ocular unit;

a lens head;

an image transmission unit for transmitting the image received by said lens head to said ocular unit; and

an illuminating device for illuminating the soldered joints disposed between the electric or electronic component and the substrate, said lens head comprising an image ~~deviation~~deflection device for changing the direction of the image path from an incoming direction from between the electric or electronic component and the substrate to an outgoing direction, said image ~~deviation~~deflection device extending up to an axially outermost end of said lens head, said illuminating device having a light exit to provide a light exit direction substantially toward said incoming direction, said light exit of said illuminating device being

disposed circumferentially besides said device for image ~~{deviation}~~deflection.

21. (AMENDED) The apparatus according to claim 20, wherein said image ~~{deviation}~~deflection device changes the direction of the image path by an image ~~{deviation}~~deflection angle, said illuminating device having a light source and a light transmission path changing the direction of light from said light source to said light exit by an angle substantially equal to said image ~~{deviation}~~deflection angle.

22. (AMENDED) A visual inspection apparatus comprising:

an image transmission unit having a longitudinal axis with first and second ends at opposite longitudinal ends, said image transmission unit transmitting an image from said first end to said second end along said longitudinal axis;

5 a head arranged at said first end of said image transmission unit, said head extending a predetermined distance from said first end of said image transmission unit;

an image ~~{deviation}~~deflection device arranged in said head and being receivable of an external image at an image axis angularly spaced from said longitudinal axis of said image transmission unit, said image ~~{deviation}~~deflection device being feedable of the external image into said first end of said image transmission unit substantially along said longitudinal axis, said image ~~{deviation}~~deflection device being receivable of the external image at substantially a farthest longitudinal distance of said head from said transmission device;

10 an illuminating device in said head, said illuminating device emitting light substantially parallel to said image axis at a longitudinal position of said image ~~{deviation}~~deflection device.
15

23. (AMENDED) An apparatus in accordance with claim 22, wherein:

said image ~~{deviation}~~deflection device is receivable of the external image over a longitudinal image distance;

said illuminating device emits the light at a position within said longitudinal image distance.

25. (AMENDED) An apparatus in accordance with claim 22, wherein:

said head includes a web longitudinally extending along one side of said image ~~{deviation}~~deflection device, said web extending to ~~to, or less than,~~ said farthest longitudinal distance.

26. (AMENDED) An apparatus in accordance with claim 22, wherein:

said head includes a web longitudinally extending along one side of said image ~~{deviation}~~deflection device, said web extending substantially ~~equal~~ to said farthest longitudinal distance.

27. (AMENDED) An apparatus in accordance with claim 25, wherein:

said head includes another web longitudinally extending along another side of said

